WHAT IS CLAIMED IS:

1. An apparatus for the detection of positioning system satellite signal distortions comprising:

a correlator that determines a plurality of correlation measurements at points along a correlation curve, wherein each correlation measurement is based upon a correlation between a received satellite signal and a reference; and,

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a signal distortion detector that determines differences between the correlation measurements along the correlation curve and that detects a signal distortion from the differences.

2. The apparatus of claim 1 wherein each of the correlation measurements represents a different time shift between the reference and the satellite signal.

3. The apparatus of claim 2 wherein all of the different time shifts are late time shifts.

4. The apparatus of claim 2 wherein all of the different time shifts are early time shifts.

5. The apparatus of claim 2 wherein the different time shifts include a late time shift and an early time shift.

6. The apparatus of claim 2 wherein the different time shifts also includes a zero time shift.

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7. The apparatus of claim 1 wherein the signal distortion detector forms a deviation between the differences and expected values of the differences and compares the deviation to a threshold in order to detect existence of the signal distortion.

8. The apparatus of claim 1 wherein the signal distortion detector forms a deviation between each of the differences and a corresponding expected value of the difference and compares each of the deviations to a corresponding threshold in order to detect existence of the signal distortion.

9. The apparatus of claim 1 wherein the signal distortion detector forms a deviation between each of the differences and a corresponding expected value of

the difference, wherein the signal distortion detector determines a single deviation value based upon the deviations, and wherein the signal distortion detector compares the single deviation value to a threshold in order to detect existence of the signal distortion.

10. The apparatus of claim 1 wherein the signal distortion detector forms a deviation between each of the differences and an expected value of the corresponding difference, wherein the signal distortion detector determines a covariance matrix based upon statistical properties of the deviations, and wherein the signal distortion detector uses the covariance matrix to perform a χ^2 procedure on the deviations to create a single deviation indicative of the signal distortion.

11. The apparatus of claim 1 wherein the signal distortion detector detects the signal distortion by forming the following expressions:

$$d_{i,j} - Ed_{i,j}$$

wherein each $d_{i,j}$ is a difference between a pair of correlation measurements i and j, and wherein $Ed_{i,j}$ is an

expected value of the difference $d_{i,j}$ when there is no signal distortion.

12. The apparatus of claim 1 wherein the signal distortion detector detects the signal distortion in accordance with the following expressions:

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$$|d_{i,j} - Ed_{i,j}| > D_{i,j}$$

wherein $d_{i,j}$ is a difference between a pair of correlation measurements i and j, wherein $Ed_{i,j}$ is an expected value of the difference $d_{i,j}$ when there is no signal distortion, and wherein $D_{i,j}$ is a threshold.

13. The apparatus of claim 12 wherein the signal distortion detector performs averaging in order to reduce effects of thermal and multipath noise.

14. The apparatus of claim 12 wherein the signal distortion detector performs filtering in order to reduce effects of thermal and multipath noise.

15. The apparatus of claim 1 wherein the signal distortion detector performs averaging in order to reduce effects of thermal and multipath noise.

16. The apparatus of claim 1 wherein the signal distortion detector performs filtering in order to reduce effects of thermal and multipath noise.

17. A method of detecting signal distortions affecting a signal transmitted by a positioning system satellite comprising:

correlating the transmitted signal with a first reference in order to determine a first correlation measurement at a first point along a correlation curve;

correlating the transmitted signal with a second reference in order to determine a second correlation measurement at a second point along the correlation curve;

correlating the transmitted signal with a third reference in order to determine a third correlation measurement at a third point along the correlation curve;

determining a first difference from the first and second correlation measurements;

determining a second difference from the second and third correlation measurements;

directly comparing the first difference to a first threshold;

directly comparing the second difference to a second threshold; and,

detecting a signal distortion in the satellite based upon the comparisons of the first and second differences to the first and second thresholds.

18. The method of claim 17 further comprising determining a third difference from the first and third correlation measurements and directly comparing the third difference to a third threshold, wherein the detection of a signal distortion comprises detecting a signal distortion in the satellite based upon the comparison of the first, second, and third differences to the first, second, and third thresholds.

19. The method of claim 17 wherein the first, second, and third correlation measurements represent different time shifts between the reference and the transmitted signal.

20. The method of claim 19 wherein all of the different time shifts are late time shifts.

21. The method of claim 19 wherein all of the different time shifts are early time shifts.

22. The method of claim 19 wherein the different time shifts include late and early time shifts.

23. The method of claim 19 wherein the different time shifts also includes a zero time shift.

24. The method of claim 17, 18, 19, 20, 21, 22, or 23 wherein the detection of the signal distortion comprises:

forming a deviation between each of the first and second differences and a corresponding expected value for the difference; and,

comparing each of the deviations to a corresponding threshold in order to detect existence of the signal distortion.

25. The method of claim 17 wherein the detection of the signal distortion comprises:

forming a deviation between each of the differences and a corresponding expected value of the difference;

determining a single deviation value based upon the deviations; and,

comparing the single deviation value to a threshold in order to detect existence of the signal distortion.

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26. The method of claim 17 wherein the detection of the signal distortion comprises:

forming a deviation between each of the differences and a corresponding expected value of the difference;

determining a covariance matrix and mean values based upon statistical properties of the deviations; and,

using the covariance matrix and mean values to perform a χ^2 procedure on the deviations to create a single deviation value indicative of the signal distortion.

27. The method of claim 26 wherein the detection of the signal distortion comprises comparing the single deviation value to a threshold in order to detect existence of the signal distortion.

28. The method of claim 17, 18, 19, 20, 21, 22, or 23 wherein the detection of the signal distortion comprises detecting the signal distortion in accordance with the following expression:

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$$d_{i,j} - Ed_{i,j}$$

wherein $d_{i,j}$ is the difference between correlation measurements i and j, and wherein $Ed_{i,j}$ is the expected value of the difference $d_{i,j}$ when there is no signal distortion.

29. The method of claim 17, 18, 19, 20, 21, 22, or 23 wherein the detection of the signal distortion comprises detecting the signal distortion in accordance with the following expression:

$$|d_{i,j} - Ed_{i,j}| > D_{i,j}$$

wherein $d_{i,j}$ is the difference between correlation measurements i and j, wherein $Ed_{i,j}$ is the expected value of the difference $d_{i,j}$ when there is no signal distortion, and wherein $D_{i,j}$ is a threshold.

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30. The method of claim 17, 18, 19, 20, 21, 22, or 23 wherein the detection of the signal distortion comprises performing averaging in order to reduce effects of thermal and multipath noise.

31. The method of claim 17, 18, 19, 20, 21, 22, or 23 wherein the detection of the signal distortion comprises filtering in order to reduce effects of thermal and multipath noise.

32. A method of detecting signal distortions affecting a signal transmitted by a positioning system satellite comprising:

correlating the transmitted signal with references in order to determine a plurality of correlation measurements at corresponding points along a correlation curve;

determining a single value from N values, wherein each value is formed based on a pair of correlation measurements, and wherein $N > 2$;

comparing the single value to a threshold; and,

detecting a signal distortion in the satellite based upon the comparison.

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33. The method of claim 32 wherein each of the correlation measurements represents a different time shift between the references and the transmitted signal.

34. The method of claim 33 wherein all of the time shifts are late time shifts.

35. The method of claim 33 wherein all of the time shifts are early time shifts.

36. The method of claim 33 wherein at least one of the time shifts is a late time shift, and wherein at least one of the time shifts is an early time shift.

37. The method of claim 33 wherein the different time shifts also includes a zero time shift.

38. The method of claim 32 wherein the determination of the single value comprises:

forming N differences between pairs of the correlation measurements; and,

determining the single value from deviations between the N difference and corresponding expected values of the N differences.

39. The method of claim 32 wherein the determination of the single value comprises:

forming N differences between pairs of the correlation measurements;

forming deviations between the N differences and expected values of the N differences;

determining a covariance matrix and mean values based upon statistical properties of the deviations;

using the covariance matrix and mean values to decorrelate the deviations in order to form new deviations that are not correlated; and,

performing a χ^2 procedure on the decorrelated deviations to determine the single value.

40. The method of claim 39 wherein the use of the covariance matrix and mean values to decorrelate the deviations comprises using the covariance to form decorrelated and normalized deviations, and wherein the χ^2 procedure is performed on the decorrelated and normalized deviations to determine the single value.

41. The method of claim 32 further comprising averaging in order to reduce effects of thermal and multipath noise.

42. The method of claim 32 further comprising filtering in order to reduce effects of thermal and multipath noise.

43. The method of claim 32 wherein the determination of the single value from N pairs of the correlation measurements comprises:

defining a covariance matrix P in accordance with the following equation:

$$P = E[(\underline{d} - \underline{m})(\underline{d} - \underline{m})^T]$$

wherein the underlines indicate vectors, wherein E[A] is a statistical expectation of A, wherein the vector $\underline{m}$ is the mean value of the vector $\underline{d}$, wherein the vector $\underline{d}$ is determined in accordance with the following equation:

$$\underline{d}^T = (d_1, d_2, d_3, d_4, \ldots, d_N)$$

wherein N is the number of deviations, wherein the deviations d_K are formed from pairs of the correlation measurements I_i and I_j according to the following equation:

$$d_K = I_i - I_j - Ed_K$$

wherein Ed_K is expected value of d_K;

determining an upper triangular matrix U and a diagonal matrix D according to the following equation:

$$P = UDU^T$$

defining $\tilde{\underline{d}}$ in accordance with the following equation:

$$\tilde{\underline{d}} = U^{-1}(\underline{d} - \underline{m})$$

wherein $\underset{\sim}{\tilde{d}}$ is a vector representing the decorrelated deviations generating the vector $\underline{d}$;

producing the following equation from the equations above:

$$P = E\,[U\,\underline{\tilde{d}}\;(U\,\underline{\tilde{d}})^T] = U\,E\,[\underline{\tilde{d}}\;(\underline{\tilde{d}})^T]\;U^T$$

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determining the following equation from the equations above:

$$D = E\,[\underline{\tilde{d}}\;(\underline{\tilde{d}})^T]$$

wherein D has the following format:

$$D = \begin{bmatrix} \tilde{\sigma} & 0 & 0 & \dots & 0 \\ 0 & \tilde{\sigma} & 0 & \dots & 0 \\ 0 & 0 & \tilde{\sigma} & \dots & 0 \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ \cdot & \cdot & \cdot & \cdot & \cdot \\ 0 & 0 & 0 & \dots & \tilde{\sigma} \end{bmatrix}$$

determining variances $\tilde{\sigma}_i^2$ from D above;

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~~determining a final χ^2 value according to the following equation:~~

$$d[\chi^2] = \sum_{i=1}^{n} \frac{\tilde{d}_i^2}{\tilde{\sigma}_i^2}$$

~~and comparing $d[\chi^2]$ to a threshold D in order to determine existence of a signal distortion.~~